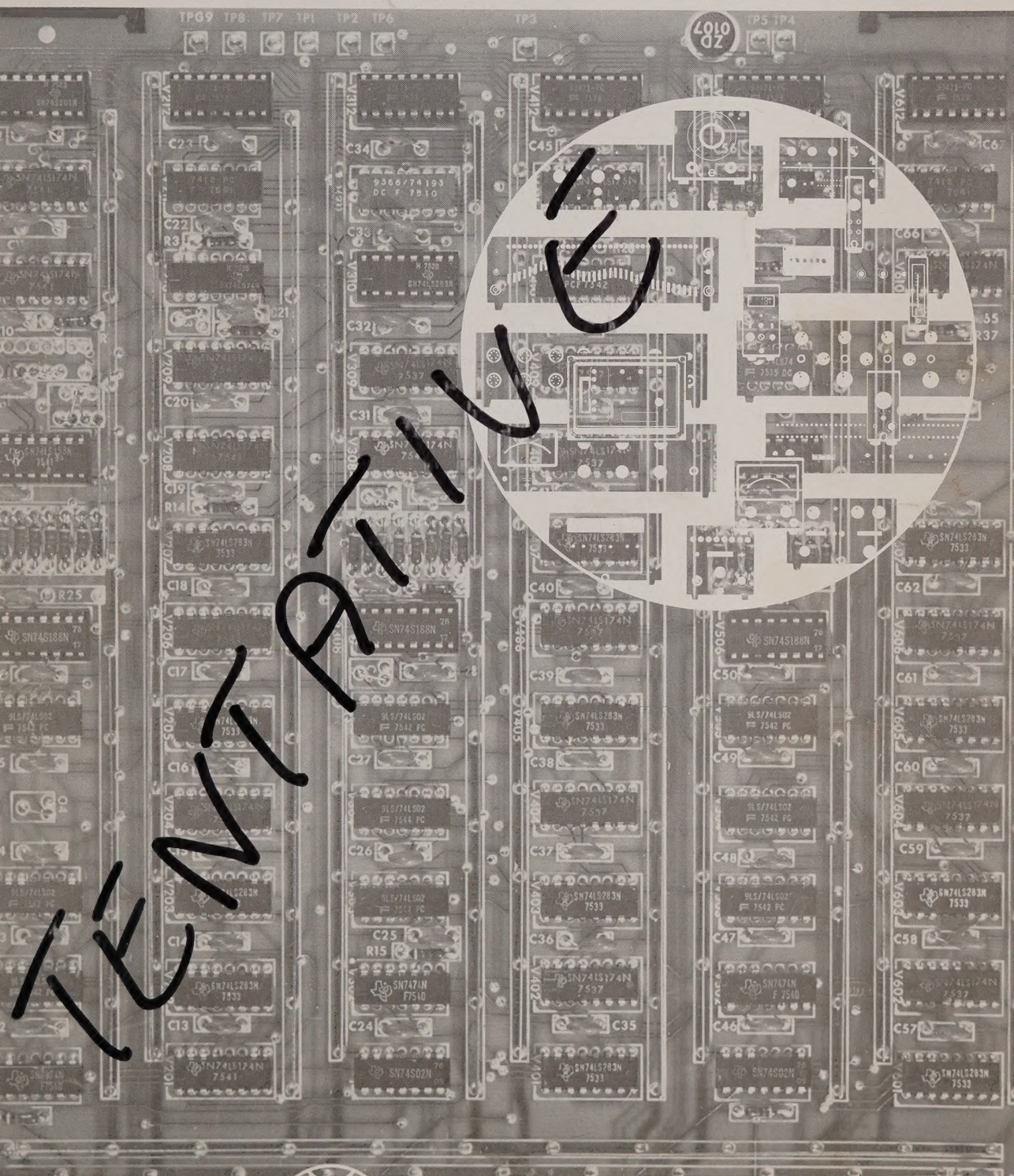
System Engineered Instrument

Instruction Manual

INSTRUKTIONS MANUAL

5899



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Instruction Manual
5899

BRÜEL & KJÆR

Apparatus for teletechnical, acoustical and vibrational research

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SAFETY CONSIDERATIONS

This apparatus has been designed and tested according to Class II of IEC publication 348 Safety Requirements for Electronic Measuring Apparatus, and has been supplied in safe condition. The present Instruction Manual contains information and warnings which should be followed by the user to ensure safe operation and to retain the apparatus in safe condition. Special note should be made of the following:

APPLICATION OF POWER

Before each use of the apparatus, check that it is set to match the available mains voltage and that the correct fuse is installed.

SAFETY SYMBOLS

The apparatus will be marked with this symbol when it is important that the user refer to the associated warning statements given in the Instruction Manual.

Chassis terminal Safety Earth terminal Hazardous voltage.

WARNINGS

Whenever it is likely that the correct function or operating safety of the apparatus has been impaired, the apparatus must be made inoperative and be secured against unintended operation.

The apparatus is designed to be operated with its signal ground and chassis at zero earth potential. Never let the signal ground terminals, socket screens or chassis float at other than approximately zero earth potential, as this will impair the operating safety of the apparatus and may damage it.

Any adjustment, maintenance and repair of the open apparatus with the mains power on must be avoided as far as possible and, if unavoidable, must be carried out only by trained service personnel.

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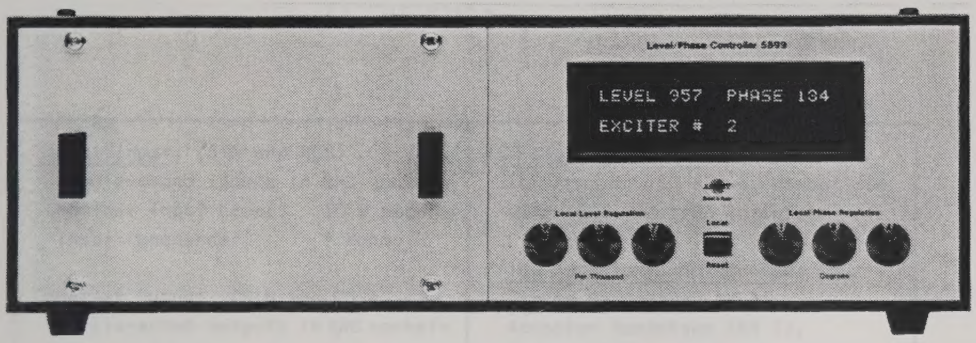
Level/Phase Controller Type 5899



FEATURES:

- ◇ Accurate Level and Phase control
- ◇ Manual or remote set-up via the IEC bus
- ◇ Bright display of level and phase parameters and associated shaker number
- ◇ High impedance inputs allowing parallel operation of many units

USES:

- ◇ Multipoint Excitation Systems
- ◇ Modal Analysis Systems

INTRODUCTION

The 5899 is a device intended for use in a multi-shaker vibration system for accurate control of vibration level and phase at one of several excitation points. Setting may be performed manually from the front panel controls or remotely via the IEC bus control. 5899 is equipped with a bright display for readout of instantaneous vibration parameters and the associated shaker number. It features high-impedance signal inputs for direct interfacing with the Exciter Control Type 1050 or for interfacing the Exciter Control Type 1047 via the master Level/Phase Controller Type 5899/WH 1887. It also features buffered constant level outputs which may be used with a slight reduction in accuracy as phase angle references for exciter proximity operation verification.

Specifications 5899

Signal Input: (SIN and COS)
Single-ended inputs in BNC sockets
Nominal Input Level: 10 V peak
Input Impedance: 1 Mohms

Constant Output: (SIN and COS)
Single-ended outputs in BNC sockets
Nominal Output Level: 10 V peak
Output Impedance: 100 ohms
Min. Load Resistance: 10 kohms

Signal Output:
Single-ended output in BNC socket
Max. Output Level: 10 V peak
Output Impedance: 100 ohms
Min. Load Resistance: 10 kohms
Harmonic Distortion: < -80 dB
Noise, DC to 10 kHz: < 100 µV RMS
Inherent Phase Shift:
referenced to cosine signal
< 1° at 1 kHz
< 3° at 10 kHz

Vibration Parameter Control:
10-position switches for manual adjustment.
Remote digital control via the IEC interface bus.

Attenuation:
Adjustable in 1/1000 steps from zero to 999/1000 of input level

Phase:
Adjustable in 1° steps from 0° to 359°

Frequency Range:
DC to 10 kHz

IEC Digital Interface:
Conforms to IEC 625-1, compatible with IEEE Std. 488 interface

IEC Functions Implemented:
Source Handshake (SH 1),
Acceptor Handshake (AH 1),
Talker (T 6), Listener (L 4),
Device Clear (DC 1)

Code:
ISO 7-bit code (i.e. ASCII, but without parity bit).

Temperature Range:
Operation: +5 to + 40°C (+41 to +104°F)
Storage: -25 to +70°C (-13 to +158°F)

Humidity:
0 to 90% RH non-condensing

Power Requirements:
Complies with IEC 348 Safety Class II.
Supply Voltage: 100, 115, 127, 200, 220, 240V AC ± 10% 50 to 60 Hz, approx. 17 VA.

Cabinet:
Supplied as model A

Dimensions:
Height: 133 mm (5,2 in)
Width: 430 mm (16,9 in)
Depth: 320 mm (12,6 in)

Weight:
Approx. 6,6 kg (14,6 lb)

2. CONTROLS

2.1. FRONT PANEL

Fig. 2.1. Front Panel of the 5899

LOCAL LEVEL REGULATION:

Three ten-position rotary switches for manual level control. Indication is from 000 to 999 per thousand of input amplitude.

LOCAL PHASE REGULATION:

One four-position and three ten-position rotary switches for manual phase control. Indication is from 000 to 399 degrees relative to the cosine signal. A switch setting higher than 359 degrees will be interpreted as 359 degrees.

LOCAL/RESET:

Three-position spring-loaded switch, biased to centre position. When depressed to its lower position (reset), the level and phase values will be reset to 000. When pressed into its upper position (local), the front panel rotary switches are scanned, and the vibration parameters subsequently updated.

DISPLAY:

The display indicates actual level and phase parameters as well as the number of the associated vibration exciter. The presence of level and phase parameters in the display also serves as an indication that power is applied to the instrument.

Note: One half of the front panel of the 5899 is equipped with handles and held in place by four screws. By loosening these screws, access is gained to the front of the PCB cage containing the plug-in circuit boards of the instrument. A PCB location drawing is found in section 6 of this manual . For diagnostic purposes, a Program Analyzer is included among the PCB's, rendering on-location fault-finding a possibility.

⚠ WARNING! Disconnect all power from the 5899 before attempting to remove its protective panels. Internal adjustments and inspections must be carried out only by a skilled person who is familiar with the hazard of dealing with live cicuitry.

⚠ WARNING! The internal capacitances of the instrument may be charged, even when the instrument is disconnected from all voltage sources.

2.2 REAR PANEL

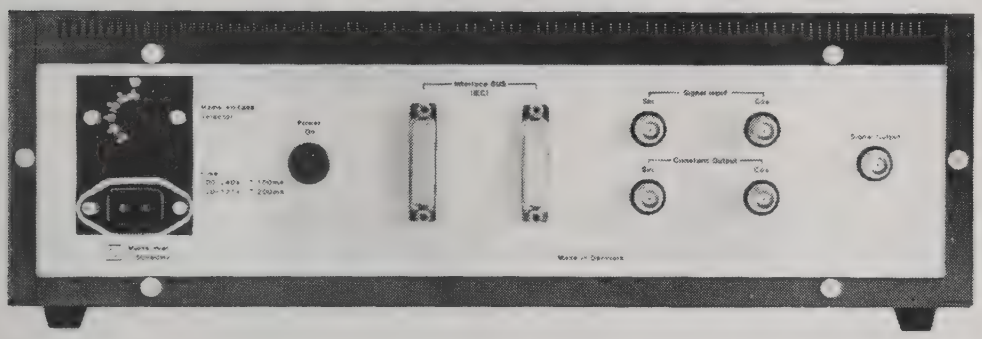


Fig. 2.2. Rear Panel of the 5899

SIGNAL INPUT
SIN and COS:

BNC sockets accepting the 10V peak quadrature signals from the Exciter Control Type 1050 or from the master Level/Phase Controller Type 5899/WH 1887.

CONSTANT OUTPUT
SIN and COS:

BNC sockets carrying buffered versions of the signals applied to the SIN and COS signal inputs.

SIGNAL OUTPUT:

A BNC socket carrying the output signal to the power amplifier.

INTERFACE BUS (IEC):

Twin 25-pole stackable connectors confroming to IEC 625-1 for the digital input and output of data. Connection to an IEC interface bus system is via IEC interface bus cable B&K part no. AO 0194. Connection to an IEEE Std. 488 interface bus system is made using cable AO 0194 and adaptor AO 0195.

POWER:

A toggle switch for the mains power supply. When switched to the 'On' position, the display will light up.

MAINS VOLTAGE SELECTOR:

A six-position selector switch to set the power transformer voltage in accordance with the mains supply available. Supplies of 100, 115, 127, 200, 220 and 240 V 50 to 60 Hz single-phase AC can be used to power the 5899 . Please refer to section 3.3.

FUSE:

A fuse-holder containing a standard 5 x 20 mm cartridge fuse. A 100 mA slow-blow fuse must be used when the instrument is powered from a 200-240V supply, a 200 mA slow-blow fuse must be used when the instrument is powered form a 100-127V supply. The fuse is removed by twisting the holder counterclockwise.

MAINS INLET:

Input socket accepting the power cable provided for connection of an AC mains supply. Before connecting the instrument to a supply, the mains voltage setting and fuse checks given in section 3.3 should be carried out.

3. PRELIMINARY

3.1. ENVIRONMENT

Specified operating characteristics of the 5899 are valid when it is used in ambient temperatures between 5°C and 40°C. The 5899 must not be subjected to temperatures outside the range -25°C to +70°C during storage. Likewise, the 5899 must not be stored or operated in humid environments exceeding 90% RH non-condensing.

3.2. MOUNTING

The 5899 is designed to be used free-standing on its four plastic feet. When supplied as model C, a Rack Flange Set KS 0038 is additionally included to enable the instrument to be mounted in a standard 19" rack.

Before mounting the rack flanges the cover strips at the front of the end panels must be removed. Withdraw the bottom panel after removing the two securing screws at the rear of the cabinet. By removing the stop clips holding the strip in place, the strip can be slid out of its retaining grooves.

WARNING! Disconnect all power from the 5899 before attempting to remove its protective panels

3.3. MAINS POWER SUPPLY

Before connecting a mains power supply the following checks and adjustments should be carried out to ensure safe operation of the apparatus.

3.3.1. Voltage Setting

The 5899 may be powered form a 100, 115, 127, 200, 220 or 240V ±10% 50 to 60 Hz single-phase AC mains supply. Select the mains voltage applicable by twisting the VOLTAGE SELECTOR disc on the rear panel with a small coin so that the appropriate voltage value faces the white notch, i.e. vertically upwards.

3.3.2. Fuse Rating

For operation from 100, 115 and 127 V supplies, a 200 mA slow-blow fuse should be used. With 200, 220 and 240 V supplies, a 100 mA slow-blow fuse should be used. Twist the fuse-holder counterclockwise to release it.

Note: Only fuses of the specified type and current rating may be used for replacement. Mended fuses and shorted fuse-holders must not be used.

3.3.3. Mains Supply Connection

The 5899 is constructed with a high degree of insulation in accordance with the requirements of IEC 348 Class II and is therefore not equipped with an earth pin in the mains input socket. A suitable mains plug should be fitted to the free end of the mains cable provided. After checking the mains VOLTAGE SELECTOR and the FUSE, the instrument may be connected to the mains supply.

4. OPERATION

4.1. PRINCIPLES OF MULTI-SHAKER OPERATION

In a multipoint excitation system, vibration level and phase is independently controlled at each excitation point to enable accurate excitation of the vibration test specimen at a particular vibration mode. All vibration exciters are fed from a high impedance output power amplifier, the input signal to which thus determines the force applied to the excitation point. Control over the phase of the applied force at each point is mandatory for mode studies, and the 5899 allows for the use of Exciter Control Type 1050 for such applications. One 5899 is needed per excitation point, all units being fed in parallel with the constant output level Sine and Cosine signals from the 1050. The 5899 may also be employed for mode studies with the Exciter Control Type 1047 in conjunction with the Level/Phase Controller Type 5899/WH 1887 serving as a master unit providing the constant level quadrature signals for the measuring system.

4.2. MANUAL SETTING OF VIBRATION PARAMETERS

The power-on default setting of vibration parameters is zero phase and zero amplitude. To change this setting, simply set the desired parameters on the rotary switches, then press 'Local', and the parameters are transferred to the internal registers of the 5899 .

4.3. DATA TRANSFER OVER THE IEC INTERFACE

The digital interface of the Type 5899 is designed according to the standard IEC 625-1 "Interface for Programmable Measuring Apparatus Byte-Serial Bit-Parallel". Since the only significant difference between this and IEEE Standard 488-1978/ANSI MC1.1-1975 is the type of connector used, compatibility with these standards is only a question of which connecting cable is used. Connection of the Type 5899 to an IEC 625-1 interface bus system is made from the IEC BUS connector on the rear panel of the Type 5899 using cable AO 0194. Connection to an IEEE/ANSI interface bus system is made from the same connector using cable AO 0194 and adaptor AO 0195.

4.3.1. IEC Functions Implemented

The interface of the Type 5899 implements the following functions, as specified by the IEC standard. The clauses referred to are the relevant sections of the IEC publication specifying the functions. The equivalent sections in the IEEE/ANSI standard are given in parentheses.

Clause 6, Source Handshake Interface (SH) Function, (Section 2.3)
SH 1 - only used with serial poll
Clause 7, Acceptor Handshake Interface (AH) Function, (Section 2.4)
AH 1 - complete capability
Clause 8, Talker Interface (T) Function, (Section 2.5)
T 6 - only used with serial poll
Clause 9, Listener Interface (L) Function, (Section 2.6)
L 4 - complete capability
Clause 13, Device Clear Interface (DC) Function, (Section 2.10)
DC 1 - complete capability

All other functions - no capability.

For further details of the above functions, refer to the relevant sections of the IEC or IEEE/ANSI standards.

4.3.2. Setting the IEC Primary Address

In order that the Talker, Listener and Device Clear interface functions of the 5899 may be remotely addressed over the Interface Bus, the device address code of the 5899 must be selected. For this purpose the ADDRESS CODING switches A5 to A1 on the IEC interface PCB should be set as indicated in table 4.3.2. The switches are accessible at the front of the IEC interface PCB just behind the removable half of the front panel.

WARNING! Disconnect all power from the 5899 before attempting to remove its protective panels.

WARNING! The internal capacitances of the instrument may be charged, even when it is disconnected from all voltage sources.

ASCII address Characters		ADDRESS CODING switch settings					Address Code	
Listen	Talk	5	4	3	2	1	Decimal	Octal
SP	@	0	0	0	0	0	0	0
!	A	0	0	0	0	1	1	1
"	B	0	0	0	1	0	2	2
#	C	0	0	0	1	1	3	3
$	D	0	0	1	0	0	4	4
%	E	0	0	1	0	1	5	5
&	F	0	0	1	1	0	6	6
'	G	0	0	1	1	1	7	7
(	H	0	1	0	0	0	8	10
)	I	0	1	0	0	1	9	11
*	J	0	1	0	1	0	10	12
+	K	0	1	0	1	1	11	13
,	L	0	1	1	0	0	12	14
-	M	0	1	1	0	1	13	15
.	N	0	1	1	1	0	14	16
/	O	0	1	1	1	1	15	17
0	P	1	0	0	0	0	16	20
1	Q	1	0	0	0	1	17	21
2	R	1	0	0	1	0	18	22
3	S	1	0	0	1	1	19	23
4	T	1	0	1	0	0	20	24
5	U	1	0	1	0	1	21	25
6	V	1	0	1	1	0	22	26
7	W	1	0	1	1	1	23	27
8	X	1	1	0	0	0	24	30
9	Y	1	1	0	0	1	25	31
:	Z	1	1	0	1	0	26	32
;	[	1	1	0	1	1	27	33
<	\	1	1	1	0	0	28	34
=	]	1	1	1	0	1	29	35
>	^	1	1	1	1	0	30	36

← Device address selected on delivery

Table 4.3.2 Address codes, plus their corresponding ASCII address characters, which may be selected with the ADDRESS CODING switches of the 5899

4.3.3. Displaying the IEC Primary Address

As an aid to setting the IEC primary address, a switch is included on the IEC interface PCB WI 2080 that displays the set IEC primary address in the lower right part of the display. In this mode, the instrument is inoperative, so the switch must be reset for normal operation. The switch is number 6 in the ADDRESS CODING switch array.

4.3.4. Setting the Associated Exciter Number

The number assigned to the associated shaker table must be set in the 5899 before remote operation is possible. The available numbers range from 1 to 16, and are set on two switches located on the IEC interface PCB and the Display Control PCB as per the following table:

Associated Exciter Number	WI 2080 IEC interface PCB ADDRESS CODING switch # 7	WI 2415 Display Control 5-pole switch #3	#2	#1
1	0	0	0	0
2	0	0	0	1
3	0	0	1	0
4	0	0	1	1
5	0	1	0	0
6	0	1	0	1
7	0	1	1	0
8	0	1	1	1
9	1	0	0	0
10	1	0	0	1
11	1	0	1	0
12	1	0	1	1
13	1	1	0	0
14	1	1	0	1
15	1	1	1	0
16	1	1	1	1

Table 4.3.4 Exciter Numbers and their corresponding switch settings in the 5899

Note: The set exciter number equals the 'Address' sent within the data frame from the systems controlling computer to the Level/Phase Controllers, whereby the different sets of level/phase data are distinguished. This way, a number of Level/Phase Controllers may be operated with the same IEC primary address.

WARNING! Disconnect all power from the 5899 before attempting to remove its protective panels.

WARNING! The internal capacitances of the instrument may be charged, even when it is disconnected from all voltage sources.

4.3.5. Incoming Data Format

When addressed by the systems controlling computer, the 5899 accepts the following incoming codes:

Axx	(<xx> :=01-16) for Address
Lyyy	(<yyy> :=000-999, default is 000) for Level
Pzzz	(<zzz> :=000-359, default is 000) for Phase
S	for Send
(000)H	for Halt

The two digits succeeding an 'A' point out which Level/Phase Controller is to have its setting updated by the following level and phase data, i.e. which exciter is affected.
The three digits succeeding an 'L' represent the new vibration level to be set by the selected Level/Phase Controller.
The three digits succeeding a 'P' represent the new phase to be set by the selected Level/Phase Controller.
On receiving the character 'S', the Level/Phase Controller updates the parameter setting to equal the values just received.
On receiving the character 'H', the 5899 resets the vibration parameters to 000, thus providing an emergency stop.

4.3.6. The 5899 Set-Up Sequence

A typical set-up sequence runs as follows:

A01 Lyyy Pzzz S A02 Lyyy Pzzz S ..... A16 Lyyy Pzzz S

where the Level/Phase Controllers are updated sequentially. If circumstances so necessitate, the Halt command can be issued at any point in the sequence, provided it is preceded by '000'.

Note: A number of Level/Phase Controllers using the smae IEC address may be connected to the IEC bus simultaneously, provided different exciter numbers are assigned to them. Refer to section 4.3.4 for setting the exciter number. The usual constraint dictated by electrical specifications for the IEC bus must still be observed, i.e. no more than 15 devices must be connected to the bus at any one time.

4.4. TEST PROGRAM FOR TYPE 5899

A simple program for testing the data transmission to an array of 5899 Level/Phase Controllers is listed and described here. The program is intended for a Hewlett-Packard Series 200 table top calculator, and any questions concerning specific commands or syntax are referred to the Hewlett-Packard "Series 200 Table Top Calculator Programming in BASIC".
The program ramps up the output voltage from 0 to 999 per thousand while sweeping the phase of the Level/Phase Controller pointed out by the user by specifying an exciter number upon request of the program. Thus transmission to all Level/Phase Controllers can be verified. The program lists as follows:

```
10   PRINT "TEST PROGRAM FOR TYPE 5899"
20   PRINT "*************************"
30   PRINT
40   PRINT
50   Address=11
60   PRINT "PRIMARY ADDRESS = ";Address
70   PRINT
80   PRINT "ENTER EXCITER # = ";
90   INPUT Number
100  PRINT number
110  Phase=0
120 Top:   !
130  FOR Level=0 TO 999
140     OUTPUT 700+Address USING "A,2Z,A,3Z,A";"A",Number,"L",Level,"P",Phase,"S"
150     SEND 7;UNL
160     Phase=Phase+1
170     IF Phase>359 THEN
180        Phase=0
190     END IF
200  NEXT Level
210  GOTO Top
220  END
```

4.5. *THE PROGRAM ANALYZER*

The Program Analyzer is a troubleshooting tool included in this microprocessor-based instrument. Refer to the PCB location drawing in section 6 of this manual. A microprocessor spends most of its time waiting for some event to occur. The Program Analyzer gives information of what the microprocessor is waiting for. This means that if any error occurs (such as i.e. a defective cable), the Program Analyzer reveals where the interfacing has stopped, thus easing the task of finding the fault. The Program Analyzer conveys its information by 16 lamps (LED's) as shown in this illustration:

	CODE	FUNCTION
•	0	Interrupt - no change
•	1	Interrupt - change
•	2	Local Loop
•	3	Set IEC_ADDRESS
•	4	Delay Display
o	5	
o	6	
o	7	
•	8	wait for RECEIVER READY
•	9	wait for TRANSMITTER READY
o	10	
o	11	
o	12	
•	13	wait-busy-display
o	14	
•	15	Start Up

5. SERVICE AND REPAIR

The 5899 is designed and constructed to provide the user with many years of reliable operation. However, should a fault occur which impairs its correct function and operating safety, then it should be immediately disconnected at the mains source and be secured against unintended operation. For repair contact your local B&K representative. Under no circumstances should repair be attempted by persons not qualified in the servicing of electronic instrumentation.

SERVICING CONSIDERATIONS

The opening of covers or removal of parts except those removable by hand is likely to produce 'live' parts. Also accessible terminals may become 'live'.

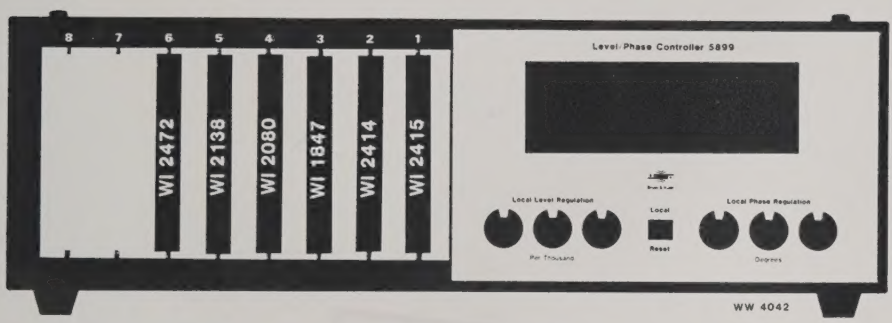
The instrument must be disconnected from all voltage sources for adjustment, replacement, maintenance and repair requiring the opening of the instrument.

If adjustment, maintenance or repair of the opened instrument is to be performed with the mains power on, it must be done by an authorized person who is familiar with the hazard.

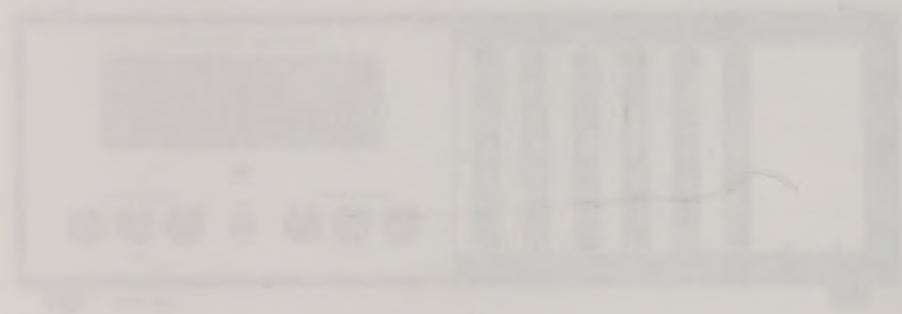
The internal capacitances of the instrument may be charged, even when the instrument is disconnected from all voltage sources.

6. DIAGRAMS

Location of Printed Circuit Boards Type 5899



Position	Subassy #	Function
1	WI 2415	Display Control
2	WI 2414	24-bit I/O port
3	WI 1847	Central Processing Unit
4	WI 2080	IEC interface
5	WI 2138	Program Analyzer
6	WI 2472	Level/Phase Control
7		Vacant
8		Vacant



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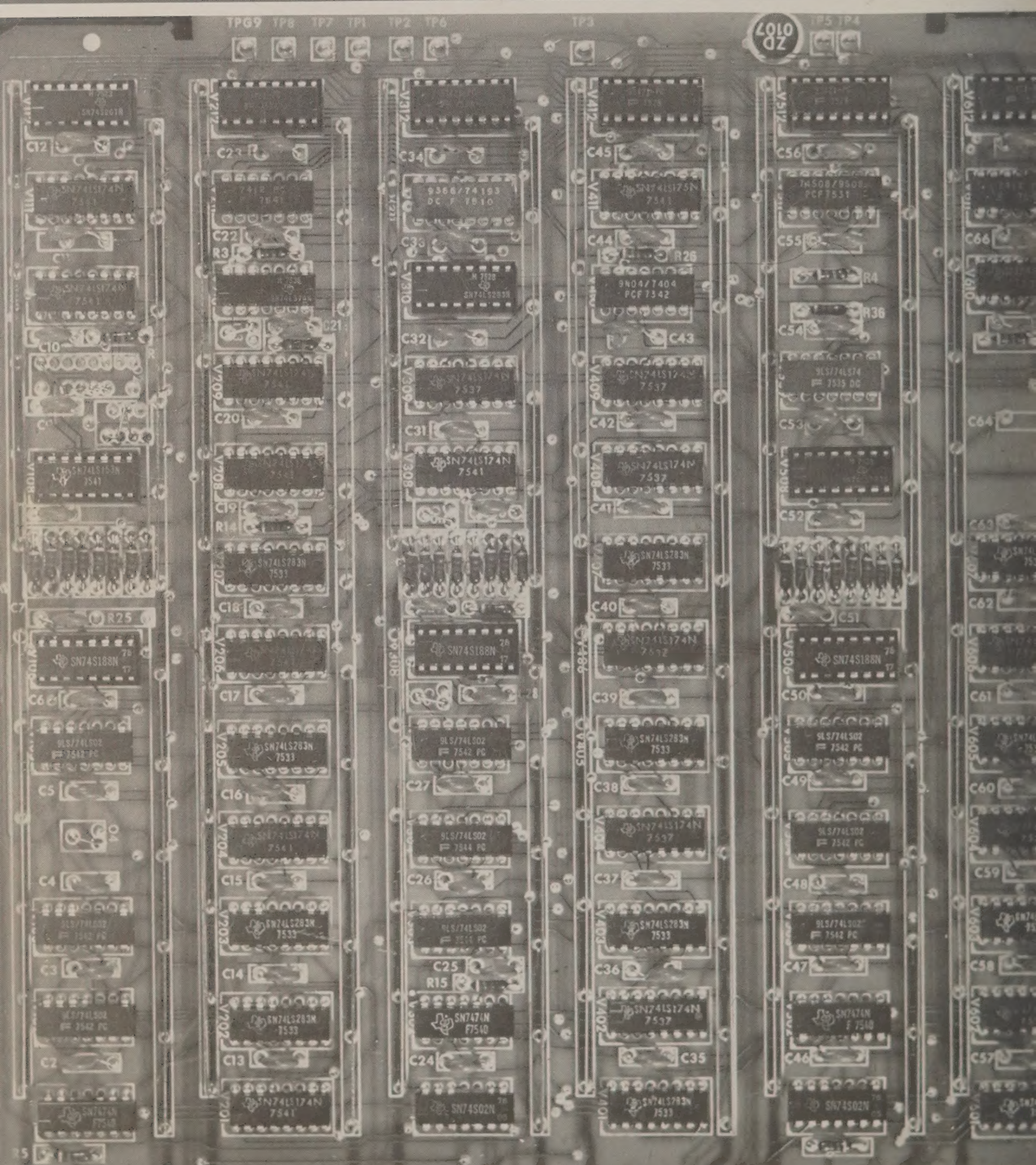

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